NASA Advisory Council Space Operations Committee

Kennedy Space Center May 3, 2011

Presented to the NASA Advisory Council on May 5, 2011

Space Operations Committee

Meeting at Kennedy Space Center, May 3, 2011

- Col. Eileen Collins (ret.), Chair
- Dr. Pat Condon, Vice Chair
 - Aerospace Consultant, former Commander of the Ogden Air Logistics Center, the Arnold Engineering Development Center, and the Air Force Armament Laboratory
- Ms. JoAnn Morgan
 - Former Kennedy Space Center Associate Director, KSC Safety & Mission Assurance Director
- Mr. Bob Sieck
 - Former Space Shuttle Launch Director

Not attending:

- Dr. Leroy Chiao
 - Former NASA Astronaut and International Space Station Commander
- Mr. Tommy Holloway
 - Former Space Shuttle and International Space Station Program Manager
- Dr. John Grunsfeld
 - Former NASA Astronaut, Deputy Director, Space Telescope Science Institute
- Mr. Jacob Keaton, Executive Secretary, NASA

Summary of Activities

Fact Finding:

- Bob Cabana, KSC Center Director
- Bill Gerstenmaier, Associate Administrator for Space Operations
- Facility Visit:
 - Operations & Checkout Building
 - SpaceX / Launch Complex 40
 - Orbiter Processing Facility / Discovery

Briefings:

- SOMD FY2012 Budget
- 21st Century Launch Complex Status Update
- Commercial Crew Development Program Status Update
- SpaceX Flight Combination Status Update

Facility Visits

- Operations & Checkout Building
 - Future home of Orion vehicle processing
 - \$55 Million in upgrades from state and federal funding
 - Facility ready to receive hardware using a paperless system approach
- SpaceX / Launch Complex 40
 - SpaceX Electronic Processing System – demonstration of capabilities
- Orbiter Processing Facility / Discovery



SOMD Budget Priorities

- Safely fly the remaining Space Shuttle manifest, including STS-135 through FY 2011 while continuing to efficiently and responsibly retire the Space Shuttle, and provide for the required pension liability for the Program's prime contractor
- Ensure safety and viability of astronauts on the International Space Station (ISS), which has been extended to 2020 and likely beyond,
 - Provide for continued operations and support of full utilization for research and enhanced functionality
 - Support research, technology development, demonstration, as well as, enhancements to the ISS facility and operations
- Support U.S. Commercial space industry to enable safe, reliable and cost effective access to low Earth orbit

SOMD Budget Priorities

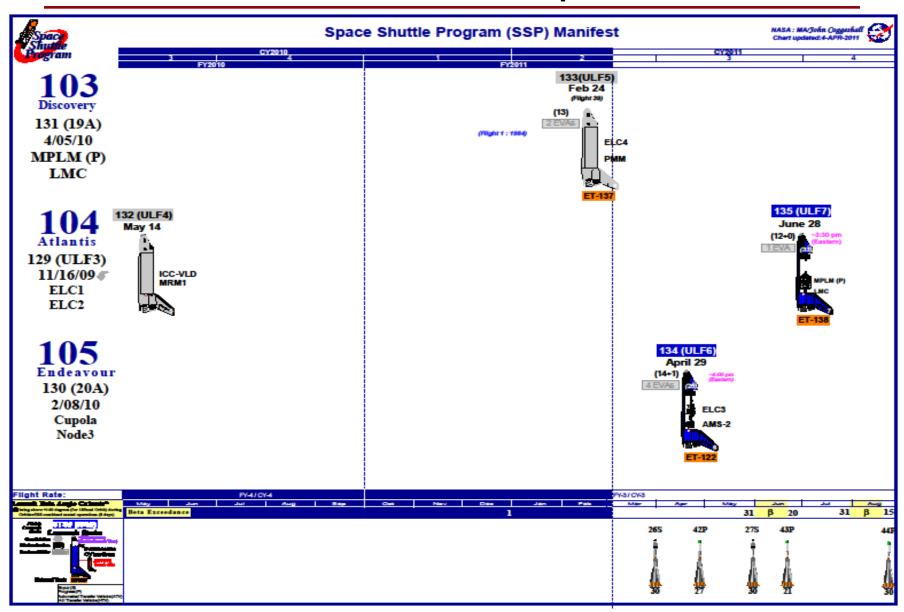
- The 21st Century Space Launch Complex Program at Kennedy Space Center
- Continue to provide launch services, rocket propulsion test facilities and space communications to our customers
- Mission Operations Sustainment provides for essential human spaceflight activities by addressing outyear space operations requirements and risk
- Currently planning to merge SOMD and Exploration Systems Mission Directorate (ESMD), to create a new directorate which will implement human spaceflight program content, in alignment with the goals of the NASA Authorization Act of 2010
 - ➤ This organization will manage all human spaceflight programs including ISS, Commercial Crew and Cargo, Space Launch System (SLS), Multi-Purpose Crew Vehicle (MPCV), and Exploration Research and Development

SOMD FY2012 Budget - Program Plan

Budget Authority (\$M)	FY 2010	FY 2011			Notional		
	Actual *	CR	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	6,141.8	5,497.5	4,346.9	4,346.9	4,346.9	4,346.9	4,346.9
Space Shuttle	<u>3,101.4</u>	<u>1,606.5</u>	664.9	<u>79.7</u>	0.8	0.8	0.9
Pension Liability			547.9				
Program Integration	627.2		38.8	28.3			
Flight and Ground Operations	1,115.4		40.6	23.1			
Flight Hardware	1,358.8		37.6	28.3	8.0	8.0	0.9
International Space Station	2,312.7	<u>2,774.2</u>	2,841.5	<u>2,960.4</u>	3,005.4	3,098.0	3,174.8
ISS System Operations and Maintenance	1,555.2		1,434.6	1,576.1	1,538.1	1,665.3	1,782.8
ISS Research	129.5		221.1	210.7	213.2	221.1	223.5
ISS Crew and Cargo Transportation	628.0		1,185.7	1,173.6	1,254.1	1,211.6	1,168.5
Space Flight Support	<u>727.7</u>	<u>1,116.8</u>	840.6	<u>1,306.8</u>	<u>1,340.7</u>	<u>1,248.1</u>	<u>1,171.2</u>
21st Century Space Launch Complex			168.0	175.3	168.1	54.8	42.9
Space Communications and Navigation	482.3		436.0	477.5	484.5	483.6	481.9
Space Communications Networks	363.3		364.5	398.2	417.9	425.2	423.2
Space Communications Support	93.5		66.3	<i>65.7</i>	66.6	58.4	58.7
TDRS Replenishment	25. <i>4</i>		5.1	13.7			
Human Space Flight Operations	112.7		111.4	112.5	112.6	115.8	116.4
Mission Operations Sustainment				415.2	443.8	459.1	391.4
Launch Services	89.4		81.3	80.3	84.6	87.0	90.4
Rocket Propulsion Test	43.3		43.9	46.0	47.1	47.8	48.2

^{*} FY2010 Op Plan as of 2/10/2011

SOMD 2011 Plans – Space Shuttle



SOMD 2011 Plans - ISS

- Complete research outfitting, deliver hardware, and pre-position critical system spares
- Maximize utilization of 6 crew to increase ISS research time availability and ramp up for full research operations
- Demonstrate Commercial Cargo transport systems
- Continue stable crew/cargo flight plan while moving toward domestic transportation capabilities for US responsibilities
- Continue planning for ISS Mars Analog Simulation



JAXA HTV

Space Shuttle

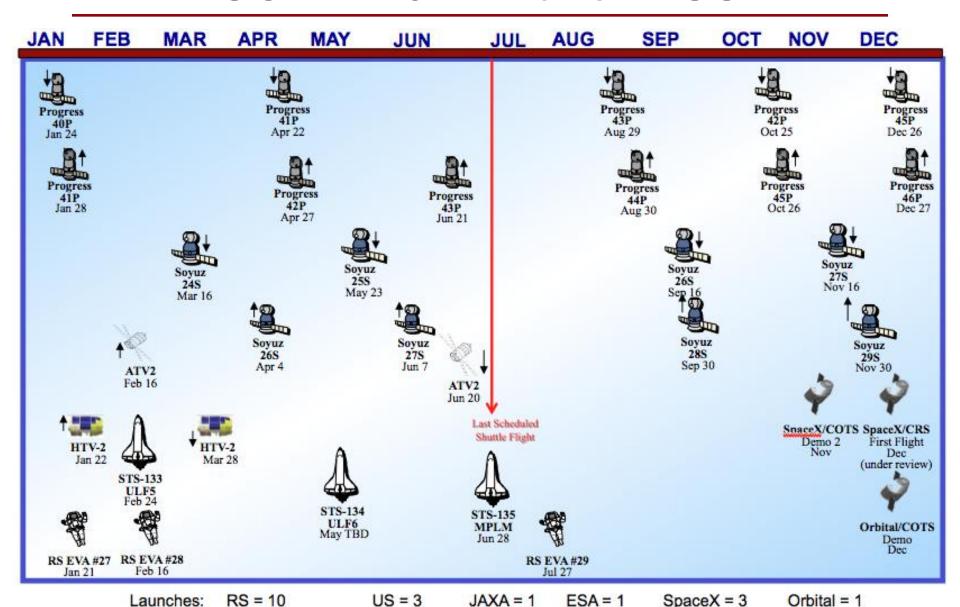


ESA ATV



Russian Progress

SOMD 2011 Plans - ISS



NASA Advisory Council Space Operations Committee

SOMD 2011 Plans - ISS

• ISS Research Statistics: ISS Expeditions 21/22 ISS Expeditions 23/24 ISS Expeditions 0-24 Oct 2009 - Mar 2010 Mar 2010 - Sept 2010 Dec 1998 - Sept 2010

Total Investigations	218	195	1149
New Investigations	56	35	
Completed Investigations	25	16	454
Scientists	496	385	1673
Countries	26	29	59

Investigations by Discipline	ISS Expeditions 21/22	ISS Expeditions 23/24	ISS Expeditions 0-24
Biology and Biotechnology	70	60	567
Earth and Space Science	21	19	39
Educational Activities	18	16	162
Human Research	39	30	146
Physical Sciences	42	43	126
Technology	28	27	109

ISS Research Budget:

RY \$ in Millions*	<u>FY 11</u>	FY12	<u>FY13</u>	<u>FY14</u>	<u>FY15</u>	FY16
Biological & Physical Research (including NPO) **	65.0	66.5	67.0	66.3	66.8	67.2
Multi-User System Support (MUSS) (Including Enabling)***	156.1	154.6	143.8	146.9	154.2	156.2
Total ISS Research	221.1	221.1	210.7	213.2	221.1	223.5

^{*} Budget in Full Cost (includes Labor)

^{**} Includes \$15 million for the NPO

^{***} MUSS is the infrastructure required to support Research

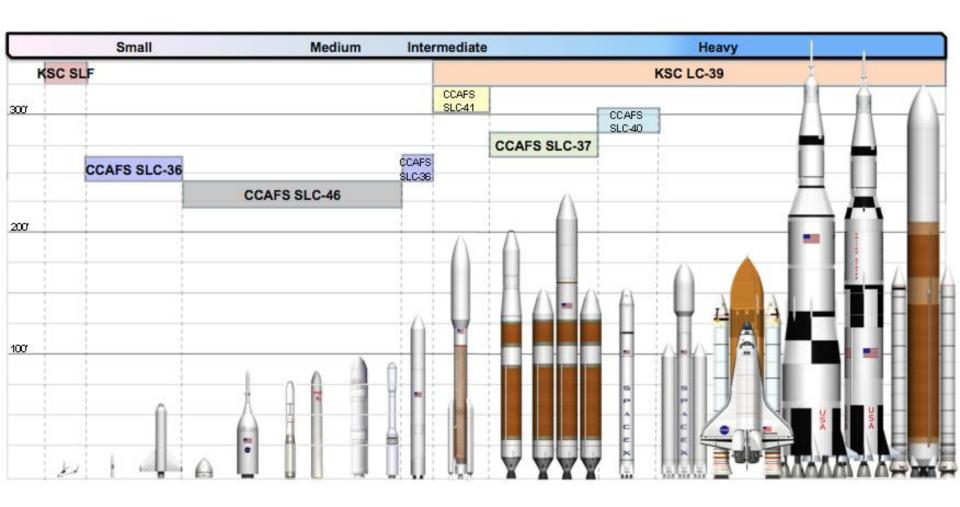
ISS Research – Management Structure

- During FY 2011, NASA will award a cooperative agreement to an independent nonprofit organization (NPO) with responsibility to further develop National Lab uses of the ISS. This organization will:
 - Act as a single entry point for non-NASA users to interface efficiently with the ISS;
 - Assist researchers in developing experiments, meeting safety and integration rules, and acting as an ombudsman on behalf of researchers;
 - Perform outreach to researchers and disseminate the results of ISS research activities; and
 - Provide easily accessed communication materials with details about laboratory facilities, available research hardware, resource constraints, and more
- The NPO will oversee all research involving organizations other than NASA and transfer current NASA biological and physical research to the NPO in future years
- An independent assessment was performed to inform the structure and process of the NPO via reference model

21st Century Launch Complex

- 21st Century Space Launch Complex will focus on upgrades to the Florida launch range, expanding capabilities to support SLS, MPCV, commercial cargo/launch services providers, and transforming KSC into a modern facility that benefits all range users, in line with the NASA Authorization Act of 2010
- SOMD has been working closely with KSC, the United States Air Force (USAF), the Federal Aviation Administration, and the space user community to refine requirements and develop a unified strategy
- Program has organized into five product lines to review requirements and select projects:
 - Modernization Mission Focused Capabilities
 - Florida Launch Modernization and Infrastructure
 - Range Interface and Control Services
 - Environmental Remediation and Technologies Capability Development
 - Off-Line Manufacturing, Processing and Recovery Capabilities

21st Century Launch Complex



21st Century Ground Systems Performance Goals

- The 21st Century Space Launch complex/Ground Systems Program transforms
 the Florida Launch and Range Complex and other NASA Flight facilities by
 implementing a focused set of investments creating the spaceport of choice. The
 Program aligns with the needs of civil, national security, and commercial
 enterprises and ultimately extends to the international space community.
- Key Concepts
 - Investments focused on common infrastructure
 - Vehicle unique requirement costs can be offset by stakeholders
 - Reduce Obsolescence & Maintenance
 - Enable multi-use capability
- Evaluating 308 candidate projects totaling \$3.6 billion
- Value Criteria (using Analytical Hierarchy Process and weighted):
 - Realized savings or tangible cost avoidance
 - Benefits to multiple customers
 - Injects current technology and reduces obsolescence
 - Urgency
 - Project risk (cost, schedule, technical)
 - Provides environmental improvements

21st Century Launch Complex

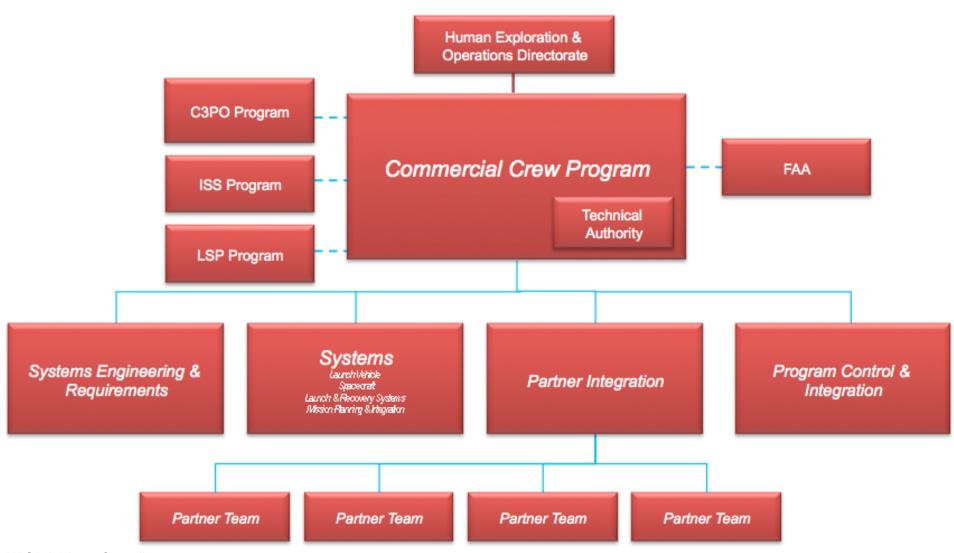
- KSC is ready to begin implementation of the 21st Century Launch Complex plan upon budgetary authorization
- Committee concern: there is no budget line item in the current fiscal year for 21st Century, which means that no new work can be implemented until the FY2012 budget is passed
- The Committee believes that the challenges presented by critical skills retention at KSC are being well-managed by both Agency and Center management

- The 2010 NASA Authorization Act established commercial crew as the primary means for ISS crew transportation.
- The program objective is to facilitate the development of a U.S. commercial crew space transportation capability for achieving safe, reliable, and cost effective access to and from LEO and the International Space Station (ISS) by late 2016.
 - Use a non-traditional acquisition and partnering approach
 - Competition is a fundamental aspect of the strategy
 - NASA could purchase commercial services to meet its ISS crew transportation needs

Program Mission

- Manage the investment in the development of commercial end-to-end transportation systems
- Manage the CTS (Crew Transportation System) certification process
- Lead the technical and programmatic partner integration and approval functions

Program Manager at KSC, Deputy PM at JSC



Four companies were selected for award:

Blue Origin: \$22M

Boeing: \$92.3M

Sierra Nevada: \$80M

SpaceX: \$75M

- Total = \$269.3M

 Within the selected concepts, there is diversity in spacecraft approaches (two capsules, a lifting body, and a biconic shape spacecraft) and in the launch vehicles they propose to use.









- Committee observes that CCP's lean organizational approach to staffing is consistent with Agency goals for commercial programs
- Committee observes a good working relationship between involved NASA centers

SpaceX Flight 2 and 3 Combination

- Proposed combination between SpaceX demonstration flights 2 and 3
 - Flight 2 November 2011 approach and rendezvous, no berthing
 - Flight 3 January 2012 rendezvous and berthing to ISS
- Committee observes very thorough analysis on verification and testing of vehicle and procedures (similar to HTV and ATV)
- Decision on flight combination expected in June 2011

Finding

Finding Title:

Human Spaceflight Mission Beyond Low Earth Orbit

Space Operations Committee Finding:

- We are impressed with the way Program and Center officials are dealing with the current budget environment; however, the lack of a well-defined human spaceflight mission beyond low Earth orbit appears to be creating inefficiencies in the way that limited budget dollars are being spent.
- We believe that a focused mission with a specific end objective, as has been the case for over 50 years, would also greatly benefit the NASA workforce, current and future domestic and international partners, and the general public.

nasa.gov



Recommendation

Short Title of the Proposed Recommendation:

Communication Strategy on NASA Websites

Short Description of the Proposed Recommendation:

 NASA websites convey mixed and inconsistent messages about the future direction of human exploration programs. The website needs to be reviewed and changed to ensure that the messages about the future direction of human exploration are consistent.

Major Reasons for Proposing the Recommendation:

 Committee members noted that it is difficult to determine the current course of human spaceflight programs via nasa.gov, as there are readily accessible pages dedicated to outdated and canceled human spaceflight programs.

Consequences of No Action on the Proposed Recommendation:

 Continuing confusion among both the NASA workforce and the general public on the state and direction of NASA's human spaceflight programs.

Next Meeting

- Joint Meeting with Exploration Committee
- Ames Research Center, August 2, 2011 (planned)
 - Briefings:
 - ISS Mars Analog Planning Status Update
 - ISS Non-Profit Organization Status Update
 - FACA Training

Summary of Activities

Fact Finding:

- KSC Center Director
- Associate Administrator for Space Operations
- Facility Visit:
 - Operations & Checkout Building
 - SpaceX / Launch Complex 40

Briefings:

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- 21st Century Launch Complex Status Update
- Commercial Crew Program Status Update
- SpaceX Flight Combination Status Update
- Finding: Human Spaceflight Mission Beyond Low Earth Orbit
- Recommendation: Communication Strategy on NASA Websites
- Future Activities

2011 Space Operations Committee Work Plan

1. International Space Station Operations:

- a) Transition from assembly phase to research phase of operations
- b) National Laboratory activities, as well as the independent, nonprofit research management organization which is being set up to develop and manage the U.S. portion of the station
- Unique operational issues associated with visiting vehicles, robotics, EVA, efficiencies in conducting science, and other issues facing longduration astronauts
- d) Examine what kind of technologies and operations might be developed and tested on ISS that could be enabling with respect to human exploration beyond LEO

2. Space Shuttle Operations:

- a) Transition of shuttle to future launch systems (ground ops, training, inflight mission operations)
- b) Workforce and infrastructure issues concerning shuttle program termination

2011 Space Operations Committee Work Plan

4. Future NASA Human Launch Systems (with Exploration committee):

 Study development and proposals for next heavy-lift human deepspace launch system with emphasis on operational impacts to ground and flight crews

5. Commercial Launch Systems (with Commercial Committee):

- a) Cargo to ISS and LEO
- b) Crew launch (including NASA astronauts) to ISS
- c) Review commercial crew certification requirements

6. KSC Spaceport Modernization:

- a) Workforce
- b) Mission accomplishment

7. Human Flight Operations, Present and Future:

- a) Extravehicular activity
- b) Rendezvous & docking
- c) Displays and controls
- d) Micro-meteorite protection
- e) Radiation protection